

WHAT IS CLAIMED IS:

1. An aqueous composition comprising:

(A) at least one water-soluble component comprising at least one functional group that undergoes a crosslinking reaction;

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(B) at least one film-forming polymer; and

(C) at least one component which provides at least one of moisture barrier properties and/or vapor barrier properties greater than that provided by a combination of components (A) and (B) alone.

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2. The composition of claim 1 wherein component (A) is selected from at least one of acrylamide-based crosslinkable polymers, polyamidoamine-epihalohydrin resins, polyamines, and polyimines.

3. The composition of claim 2 wherein component (A) comprises acrylamide-based crosslinkable polymers.

4. The composition of claim 3 wherein component (A) comprises cationic functionalized polyacrylamides.

5. The composition of claim 2 wherein the functional group of component (A) is selected from at least one of epoxy, azetidinium, aldehyde, carboxyl group, acrylate and derivatives thereof, acrylamide and derivatives thereof, and quaternary amine.

20 6. The composition of claim 5 wherein the functional group of component (A) is selected from at least one of epoxy and azetidinium.

7. The composition of claim 2 wherein the film-forming polymer is selected from at least one polymer derived from monomers of alkyl halides of from 2-12 C atoms,

alkene halides of from 2-12 C atoms, alkyl acrylamides of from 2-12 C atoms, alkene acrylamides of from 2-12 C atoms, alkyl acrylates of from 2-12 C atoms, and alkene acrylates of from 2-12 C atoms.

8. The composition of claim 7 wherein the film-forming polymer is selected from at least one polymer derived from at least one monomer selected from at least one of styrene, dimethylstyrene, vinyltoluene, chloroprene, butadiene, ethylene, acrylamide, acrylonitrile, acrolein, methylacrylate, ethylacrylate, acrylic acid, methacrylic acid, methyl methacrylate, n-butyl acrylate, vinylidene chloride, vinyl ester, vinyl chloride, vinyl acetate, acrylated urethane, hydroxyethyl acrylate, dimethylaminoethyleneacrylate, and vinyl acetate.

9. The composition of claim 2 wherein the film-forming polymer comprises a latex selected from at least one polymer derived from at least one monomer comprising repeating units derived from an alkyl halide having at least one double bond and an alkene, wherein the alkyl halide has from 2 to 12 C atoms, and wherein the alkene has from 2 to 12 C atoms.

15 10. The composition of claim 9 wherein the alkyl halide comprises a vinyl halide.

11. The composition of claim 10 wherein the alkyl halide comprises a vinyl halide and the alkene comprises an olefin.

12. The composition of claim 9, wherein the alkyl halide comprises a vinyl halide and the alkene comprises ethylene.

20 13. The composition of claim 12, wherein the vinyl halide comprises vinyl chloride.

14. The composition of claim 13 wherein the alkyl halide comprises a vinyl chloride and the alkene comprises ethylene.

*sub A2*

15. The composition of claim 7 wherein component (C) is selected from one of sizing materials, ketene dimers, alkenyl succinic anhydrides, fatty acids, and wax emulsions.

5 16. The composition of claim 15 wherein the sizing material is a ketene dimer compound prepared from fatty acids of from 16 to 22 C atoms.

17. The composition of claim 16 wherein the sizing material is a ketene dimer compound prepared from fatty acids of from 16 to 18 C atoms.

10 18. The composition of claim 15 wherein the wax emulsion is selected from at least one of slack or microcrystalline wax.

19. The composition of claim 15 wherein the dry weight ratio of (A) and (B) to (C) is about 99:1 to 1:99.

20. The composition of claim 19 wherein the dry weight ratio of (A) and (B) to (C) is about 70:30 to about 10:90.

*sub 15 X3*

21. The composition of claim 20 wherein the dry weight ratio of (A) and (B) to (C) is about 60:40 to about 30:70.

22. The composition of claim 15 further comprising a fluoacid.

23. The composition of claim 19 further comprising a fluoacid.

24. A substrate coated with a cured composition of claim 1.

25. A substrate coated with a cured composition of claim 2.

26. A metal substrate coated with a cured composition of claim 22.

27. The metal substrate of claim 26, wherein the fluoacid is selected from at least one of fluotitanic acid and fluozirconic acid.

28. The metal substrate of claim 27, wherein the composition has a pH from about 1.5 to about 5.0.

29. A metal substrate coated with a cured composition of claim 23.

30. The metal substrate of claim 29, wherein the fluoacid is selected from at least one of fluotitanic acid and fluozirconic acid.

31. The metal substrate of claim 30, wherein the composition has a pH from about 1.5 to about 5.0.

32. A cellulosic product comprising a cured composition of claim 1.

33. A cellulosic product comprising a cured composition of claim 2.

34. A ceiling tile comprising a cured composition of claim 1.

35. A non-woven product comprising a cured composition of claim 1.

36. A latex extender comprising a cured composition of claim 1.

37. A paint comprising a cured composition of claim 1.

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The composition of claim 8 wherein component (C) is selected from one of sizing materials, ketene dimers, alkenyl succinic anhydrides, fatty acids, and wax emulsions.

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39. The composition of claim 38 wherein the dry weight ratio of (A) and (B) to (C) is about 99:1 to 1:99.

40. The composition of claim 39, further comprising a fluoacid.

41. A metal substrate coated with a cured composition of claim 40.

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42. The metal substrate of claim 41, wherein the fluoacid is selected from at least one of fluotitanic acid and fluozirconic acid.

43. The metal substrate of claim 42, wherein the composition has a pH from about 1.5 to about 5.0.

44. A cellulosic product comprising a cured composition of claim 39.

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45. A latex extender comprising a cured composition of claim 39.

46. A non-woven product comprising a cured composition of claim 39.

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A method of preparing a coated substrate which comprises:

(1) coating a substrate with a coating composition comprising:

(A) at least one water-soluble component comprising at least one functional group that undergoes a crosslinking reaction; (B) at least one film-forming polymer; and (C) at least one component which provides at least one of moisture barrier properties and/or vapor barrier properties greater than that provided by a combination of components (A) and (B) alone; and

(2) curing the coating composition on the substrate.

48. The method of claim 47 wherein component (A) is selected from at least one of acrylamide-based crosslinkable polymers, polyamidoamine-epihalohydrin resins, polyamines, and polyimines.

49. The method of claim 48 wherein component (A) comprises acrylamide-based crosslinkable polymers.

50. The method of claim 48 wherein component (A) comprises cationic functionalized polyacrylamides.

51. The method of claim 48 wherein the functional group of component (A) is selected from at least one of epoxy, azetidinium, aldehyde, carboxyl group, acrylate and derivatives thereof, acrylamide and derivatives thereof, and quaternary amine.

52. The method of claim 51 wherein the functional group of component (A) is selected from at least one of epoxy and azetidinium.

53. The method of claim 48 wherein the film-forming polymer is selected from at least one polymer derived from monomers of alkyl halides of from 2-12 C atoms, alkene halides of from 2-12 C atoms, alkyl acrylamides of from 2-12 C atoms, alkene acrylamides

of from 2-12 C atoms, alkyl acrylates of from 2-12 C atoms, and alkene acrylates of from 2-12 C atoms.

54. The method of claim 53 wherein the film-forming polymer is selected from at least one polymer derived from at least one monomer selected from at least one of styrene, dimethylstyrene, vinyltoluene, chloroprene, butadiene, ethylene, acrylamide, acrylonitrile, acrolein, methylacrylate, ethylacrylate, acrylic acid, methacrylic acid, methyl methacrylate, n-butyl acrylate, vinylidene chloride, vinyl ester, vinyl chloride, vinyl acetate, acrylated urethane, hydroxyethyl acrylate, dimethylaminoethyleneacrylate, and vinyl acetate.

10 55. The method of claim 47 wherein the film-forming polymer comprises a latex selected from at least one polymer derived from at least one monomer comprising repeating units derived from an alkyl halide having at least one double bond and an alkene, wherein the alkyl halide has from 2 to 12 C atoms, and wherein the alkene has from 2 to 12 C atoms.

15 56. The method of claim 55 wherein the alkyl halide comprises a vinyl halide and the alkene comprises an olefin.

57. The method of claim 56, wherein the alkyl halide comprises a vinyl halide and the alkene comprises ethylene.

20 58. The method of claim 53 wherein component (C) is selected from one of sizing materials, ketene dimers, alkenyl succinic anhydrides, fatty acids, and wax emulsions.

59. The method of claim 58 wherein the sizing material is a ketene dimer compound prepared from fatty acids having C<sub>16</sub> to C<sub>22</sub>.

60. The method of claim 58 wherein the dry weight ratio of (A) and (B) to (C) is about 99:1 to 1:99.

61. The method of claim 60 wherein the dry weight ratio of (A) and (B) to (C) is about 60:40 to 30:70.

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62. The method of claim 58 further comprising a fluoacid.

63. The method of claim 60 further comprising a fluoacid.

64. A metal substrate prepared by the method of claim 62.

65. The metal substrate of claim 64, wherein the fluoacid is selected from at least one of fluotitanic acid and fluozirconic acid.

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66. The metal substrate of claim 65 wherein the composition has a pH from about 1.5 to about 5.0.

67. A metal substrate prepared by the method of claim 63.

68. The metal substrate of claim 67, wherein the fluoacid is selected from at least one of fluotitanic acid and fluozirconic acid.

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69. The metal substrate of claim 68, wherein the composition has a pH from about 1.5 to about 5.0.

70. The method of claim 50 wherein the film-forming polymer is selected from at least one polymer derived from monomers of alkyl halides of from 2-12 C atoms, alkene

halides of from 2-12 C atoms, alkyl acrylamides of from 2-12 C atoms, alkene acrylamides of from 2-12 C atoms, alkyl acrylates of from 2-12 C atoms, and alkene acrylates of from 2-12 C atoms.

71. The method of claim 70 wherein component (C) is selected from one of sizing materials, ketene dimers, alkenyl succinic anhydrides, fatty acids, and wax emulsions.

72. The method of claim 71 wherein the dry weight ratio of (A) and (B) to (C) is about 99:1 to 1:99.

73. The method of claim 72, further comprising a fluoacid.

74. A metal substrate prepared by the method of claim 73.

75. The metal substrate of claim 74, wherein the fluoacid is selected from at least one of fluotitanic acid and fluozirconic acid.

76. The metal substrate of claim 75, wherein the composition has a pH from about 1.5 to about 5.0.

77. A method of preparing cellulosic products which comprises:

(1) substantially simultaneously or sequentially adding a composition to a system comprising cellulosic fibers,

wherein the system is selected from at least one of aqueous system, felt, web, and combinations thereof

(A) at least one water-soluble component comprising at least one functional group that undergoes a crosslinking reaction; (B) at least one film-forming polymer; and (C) at least one component which provides at least one of moisture barrier properties and/or vapor

barrier properties greater than that provided by a combination of components (A) and (B) alone.

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78. The method of claim 77 wherein component (A) is selected from at least one of acrylamide-based crosslinkable polymers, polyamidoamine-epihalohydrin resins, polyamines, and polyimines.

79. The method of claim 78 wherein component (A) comprises acrylamide-based crosslinkable polymers.

80. The method of claim 79 wherein component (A) comprises cationic functionalized polyacrylamides.

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81. The method of claim 78 wherein the functional group of component (A) is selected from at least one of epoxy, azetidinium, aldehyde, carboxyl group, acrylate and derivatives thereof, acrylamide and derivatives thereof, and quaternary amine.

82. The method of claim 81 wherein the functional group of component (A) is selected from at least one of epoxy and azetidinium.

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83. The method of claim 78 wherein the film-forming polymer is selected from at least one polymer derived from monomers of alkyl halides of from 2-12 C atoms, alkene halides of from 2-12 C atoms, alkyl acrylamides of from 2-12 C atoms, alkene acrylamides of from 2-12 C atoms, alkyl acrylates of from 2-12 C atoms, and alkene acrylates of from 2-12 C atoms.

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84. The method of claim 83 wherein the film-forming polymer is selected from at least one polymer derived from at least one monomer selected from at least one of styrene,

dimethylstyrene, vinyltoluene, chloroprene, butadiene, ethylene, acrylamide, acrylonitrile, acrolein, methylacrylate, ethylacrylate, acrylic acid, methacrylic acid, methyl methacrylate, n-butyl acrylate, vinylidene chloride, vinyl ester, vinyl chloride, vinyl acetate, acrylated urethane, hydroxyethyl acrylate, dimethylaminoethyleneacrylate, and vinyl acetate.

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85. The method of claim 78 wherein the film-forming polymer comprises a latex selected from at least one polymer derived from at least one monomer comprising repeating units derived from an alkyl halide having at least one double bond and an alkene, wherein the alkyl halide has from 2 to 12 C atoms, and wherein the alkene has from 2 to 12 C atoms.

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86. The method of claim 85 wherein the alkyl halide comprises a vinyl halide and the alkene comprises an olefin.

87. The method of claim 85, wherein the alkyl halide comprises a vinyl halide and the alkene comprises ethylene.

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88. The method of claim 83 wherein component (C) is selected from one of sizing materials, alkenyl succinic anhydrides, fatty acids, and wax emulsions.

89. The method of claim 88 wherein the sizing material is a ketene dimer compound prepared from fatty acids of from 16 to 22 C atoms.

90. The method of claim 88 wherein the dry weight ratio of (A) and (B) to (C) is about 99:1 to 1:99.

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91. The method of claim 90 wherein the dry weight ratio of (A) and (B) to (C) is about 60:40 to 30:70.

92. The method of claim 80 wherein the film-forming polymer is selected from at least one polymer derived from monomers of alkyl halides of from 2-12 C atoms, alkene halides of from 2-12 C atoms, alkyl acrylamides of from 2-12 C atoms, alkene acrylamides of from 2-12 C atoms, alkyl acrylates of from 2-12 C atoms, and alkene acrylates of from 2-12 C atoms.

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93. The method of claim 92 wherein component (C) is selected from one of sizing materials, alkenyl succinic anhydrides, fatty acids, and wax emulsions.

94. The method of claim 92 wherein the dry weight ratio of (A) and (B) to (C) is about 60:40 to 30:70.

10 95. A cellulosic product prepared by the method of claim 94.

96. A ceiling tile prepared by the method of claim 94.

97. A non-woven product prepared by the method of claim 94.

15 98. A method for forming a substantially chromium-free, dried in place conversion coating on a metal surface comprising applying to a metal surface:

20 (1) an aqueous composition comprising (A) at least one water-soluble component comprising at least one functional group that undergoes a crosslinking reaction; (B) at least one film-forming polymer; and (C) at least one component which provides at least one of moisture barrier properties and/or vapor barrier properties greater than that provided by a combination of components (A) and (B) alone; and

(2) fluoacid,

wherein the amount of the composition in (1) is from about 0.1 to about 90% by weight, and

wherein the amount of fluoacid is from about 0.2 to about 20% by weight.

99. The method of claim 98 wherein said coating composition is dried in place on surface of said substrate.

100. The method of claim 98 further comprises rinsing said coating composition from said coated substrate.

101. The method of claim 98, wherein the fluoacid is selected from at least one of fluotitanic acid and fluozirconic acid.

102. The method of claim 101, wherein the composition has a pH from about 1.5 to about 5.0.

103. The method of claim 102 wherein component (A) is selected from at least one of acrylamide-based crosslinkable polymers, polyamidoamine-epihalohydrin resins, polyamines, and polyimines.

104. The method of claim 103 wherein component (A) comprises acrylamide-based crosslinkable polymers.

105. The method of claim 103 wherein the functional group of component (A) is selected from at least one of epoxy, azetidinium, aldehyde, carboxyl group, acrylate and derivatives thereof, acrylamide and modification thereof, and quaternary amine.

106. The method of claim 105 wherein the functional group of component (A) is selected from at least one of epoxy and azetidinium.

107. The method of claim 103 wherein the film-forming polymer is selected from at least one polymer derived from monomers of alkyl halides of from 2-12 C atoms, alkene halides of from 2-12 C atoms, alkyl acrylamides of from 2-12 C atoms, alkene acrylamides of from 2-12 C atoms, alkyl acrylates of from 2-12 C atoms, and alkene acrylates of from 2-12 C atoms.

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108. The method of claim 107 wherein the film-forming polymer is selected from at least one polymer derived from at least one monomer selected from at least one of styrene, dimethylstyrene, vinyltoluene, chloroprene, butadiene, ethylene, acrylamide, acrylonitrile, acrolein, methylacrylate, ethylacrylate, acrylic acid, methacrylic acid, methyl methacrylate, n-butyl acrylate, vinylidene chloride, vinyl ester, vinyl chloride, vinyl acetate, acrylated urethane, hydroxyethyl acrylate, dimethylaminoethyleneacrylate, and vinyl acetate.

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109. The method of claim 101 wherein the film-forming polymer comprises a latex selected from at least one polymer comprising repeating units derived from an alkyl halide having at least one double bond and an alkene, wherein the alkyl halide has from 2 to 12 C atoms, and wherein the alkene has from 2 to 12 C atoms.

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110. The method of claim 107 wherein component (C) is a polymer selected from one of sizing materials, alkenyl succinic anhydrides, fatty acids, and wax emulsions.

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111. The method of claim 110 wherein the sizing material is a ketene dimer compound prepared from fatty acids of from 16 to 22 C atoms.

112. The method of claim 110 wherein the dry weight ratio of (A) and (B) to (C) is about 99:1 to 1:99.

113. The method of claim 112 wherein the dry weight ratio of (A) and (B) to (C) is about 60:40 to 30:70.

114. A metal substrate prepared by the method of claim 98.

115. A metal substrate prepared by the method of claim 103.

5 116. A metal substrate prepared by the method of claim 107.

117. A metal substrate coated by the method of claim 109.

118. A metal substrate coated by the method of claim 112.